

**Apprenticeship
In-school Curriculum Standards**

Welder and Metal Fabricator

Level 1 – Common Core

456A and 437A

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Level 1 – Common Core

456A and 437A

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WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

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Introduction

This new curriculum standard for the Welder/Metal Fabricator Level I Common Core trade is based upon the on-the-job performance objectives, located in the industry-approved training standard.

The curriculum is organized into 3 levels of training. The Program Summary of Reportable Subjects chart summarizes the training hours for each reportable subject.

The curriculum identifies only the learning that takes place off-the-job. The in-school program focuses primarily on the theoretical knowledge and the essential skills required to support the performance objectives of the Apprenticeship. Employers/Sponsors are expected to extend the apprentice's knowledge and skills through practical training on the work site. Regular evaluations of the apprentice's knowledge and skills are conducted throughout training to ensure that all apprentices have achieved the learning outcomes identified in the curriculum standard.

It is not the intent of the in-school curriculum to perfect on-the-job skills. The practical portion of the in-school program is used to reinforce theoretical knowledge. Skill training is provided on the job.

Welder/Metal Fabricator

Level 1 – Common Core

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

Program Summary of Reportable Subjects – Level 1

Number	Reportable Subjects	Hours Total	Hours Theory	Hours Practical
S0881	Trade Practices	33	28	5
S0882	Applied Blueprint Reading	60	39	21
S0883	Welding Theory I	30	30	0
S0884	Material and Process Quality I	27	27	0
S0885	Shielded Metal Arc Welding (SMAW) Practical I	69	3	66
S0886	Gas Shielded Semi- Automatic Welding Practical I	54	2	52
S0887	Thermal Cutting	27	9	18
	Total	300	138	162

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

Number: **S0881**

Reportable Subject: **TRADE PRACTICES**

Duration: Total 33 hours Theory 28 hours Practical 5 hours

Content: S0881.1 General Safety
S0881.2 Hand Tools/ Power Tools
S0881.3 Trade Calculations

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
60%	20%	10%	10%	

General Safety - earplugs and muffs, leather gloves, face shields, leather jackets, fire blankets, masks, fire extinguishers, respirators, goggles, safety glasses, leather aprons

Tools & Equipment:

Hand Tools / Power Tools - adjustable wrenches, Allen wrenches, bench vice, "C" clamps, chalk-line, cold chisels, electric extension cords, files, friction lighter, grinding and sanding disks, hacksaw, hammers, hand shears, layout table, magnets, metal markers, pipe clamps, pipe cutter, pipe wrenches, pliers, positioners, pry bars, punches, screwdrivers, scribes, snips, soapstone markers, socket sets, temperature indicating crayons, tip cleaners, toolboxes, tungsten sharpening grinders, vice grips, wire brushes, wire cutters, wrench sets, sanders, electric drills, angle grinders, grinders

Trade Calculations - calculators

INSTRUCTIONAL STRATEGIES: demonstrations and practice, continuing appropriate use, periodic quizzes, math applications

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0881.1 General Safety

Duration: Total 12 hours Theory 12 hours Practical 0 hours

Cross-Reference to Training Standard: 6017.01, .02, .03, .04, .05; 6003.02; 6000.04; 6001.01, .02, .03, .04, .05, .06; 6006.03, .04 14.0, 2.1, 2.3

GENERAL LEARNING OUTCOME

Describe the safe material handling operations, Industrial Safety Acts and potential workplace hazards in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 1.1 Discuss the history and growth of the welding and fabrication sector.
 - forge welding
 - resistance welding
 - gas welding
 - fusion welding
 - welding defined
 - fabrication methods defined

- 1.2 Explain material handling components and techniques and inspection methods.
 - rigging/hoisting/material handling
 - equipment selection
 - tuggers
 - cable clamps
 - chain block hoists
 - chokers
 - connectors
 - ropes
 - chains
 - slings
 - clevises
 - hooks and plate clamps
 - spreaders
 - turning weldments
 - cranes
 - hand signals
 - mobile
 - jib

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

1.2 Continued

- overhead
- forklifts
- jacks
- come-along

1.3 Describe the necessary personal protection against common shop and construction hazards.

- electrical shock
 - water and electricity
 - good ground connection
 - cable connection
- fumes and gases
 - appropriate helmet and filter plates
 - flow meters
 - spatter
 - ozone
- fire
 - heat and burns
 - sparks
 - appropriate clothing
- radiation
 - Ultra Violet
 - Infra Red
 - white light
- noise
- fall protection
- falling objects

1.4 Explain the safe use and operation of equipment.

- storage and handling of compressed gas cylinders
- power tools
- hand tools
- fabricating equipment
- automated equipment
- lockout
- scaffolding
- safety harness

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

- 1.5 Describe the *Workplace Hazardous Materials Information System (WHMIS)*.
 - right to know
 - legislation
 - safe handling of products
 - hazardous materials
 - Material Safety Data Sheets (MSDS)

- 1.6 Describe the *Occupational Health and Safety Act (OHSA)*.
 - legislation
 - responsibility of employer and employee

- 1.7 Identify potential Workplace Hazards.
 - confined spaces
 - oxygen depletion
 - moving equipment
 - tripping hazards
 - emergency responses
 - incident reports
 - fires

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0881.2 Hand Tools / Power Tools

Duration: Total 9 hours Theory 4 hours Practical 5 hours

Cross Reference to Training Standard: 6000.01 1.1, 1.2, 1.3, 8.1, 9.2.4, 9.2.5

GENERAL LEARNING OUTCOME

Use measuring, small hand and power tools in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

2.1 Describe the application and use of small hand and power tools.

- small hand tools
 - chipping hammer
 - wire brush
 - side cutters
 - hammer
 - cold chisel
 - pliers
 - vise grips
 - hack saw
 - scalers
- pneumatic powered hand tools
- electric powered hand tools
 - wheel grinders
 - pedestal grinders
 - disc grinders
 - portable drills
- bench grinders
- abrasive cut-off saws
- die grinders
- drill press
- nibblers

2.2 Use welding measuring tools.

- fillet gauge
- contour gauge
- throat gauges

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

2.3 Use fit-up measurement tools

- measuring tape
- ruler
- vernier
- micrometer
- level
- centre head
- combination square
- protractor
- bevel angle
- calibration

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0881.3 Trade Calculations

Duration: Total 12 hours Theory 12 hours Practical 0 hours

Cross Reference to Training Standard: 6001.04 4.1.1, 8.1

GENERAL LEARNING OUTCOME

Explain basic arithmetic, applied calculations, systems of measurements and basic geometry in accordance with the requirements for the welding and fabricating trades.

LEARNING OUTCOMES AND CONTENT

- 3.1 Define the fundamentals of basic arithmetic and perform the applied calculations.
 - adding, subtracting, multiplying and dividing
 - exponents and square root
 - mathematical calculations:
 - work orders
 - estimates
 - invoices
 - use of calculators
- 3.2 Explain the procedures and perform calculations.
 - fractions and decimals
 - converting fractions to decimals and decimals to fractions
 - percentages
- 3.3 Explain fundamental formulas and perform calculations.
 - perimeter
 - circumference
 - area
 - volume
 - mass
 - pressure
- 3.4 Explain the fundamentals of systems of measurement and perform calculations.
 - difference between metric and imperial systems of measurement
 - use of conversion tables and charts

- 3.5 Explain the fundamentals of basic geometry and perform basic “geometric shapes” calculations.
- angular measurements and calculations
 - right angle triangle
 - Pythagorean theorem
 - 3-4-5 triangle

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

Number: **S0882**

Reportable Subject: **APPLIED BLUEPRINT READING**

Duration: Total 60 hours Theory 39 hours Practical 21 hours

Content: S0882.1 Applied Blueprint Reading
S0882.2 Joint Design and Welding Symbols

Evaluation & Testing: Assignments related to theory and appropriate application skills.
Minimum of one mid-term test during the term.
Final exam at end of term.
Periodic quizzes.

Mark Distribution:

Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
70%	10%	10%	10%	

S0882.1 Applied Blueprint Reading

Duration: Total 51 hours Theory 30 hours Practical 21 hours

Cross Reference to Training Standard: 6006.01, .02; 6004.01 4.1.1, 4.1.2, 5.1

GENERAL LEARNING OUTCOME

Perform drawings, common views and basic drafting and sketching operations as applied to the welder/fabricator programs.

LEARNING OUTCOMES AND CONTENT

- 1.1 Describe the content and organization of drawings.
 - purpose of a drawing
 - components of the drawing
 - lines
 - views
 - symbols
 - title block
 - list of materials
 - notes and specifications
 - types of working drawings
 - engineering drawings
 - erection drawings
 - erection diagrams
 - architectural drawings
 - assembly prints
 - sub-assembly prints
 - overview of CAD drawings
 - blueprints
 - shop details or working drawings
 - sketches
 - common scales
 - imperial and metric measurements
 - third angle projection
 - first angle projection

- 1.2 Define the purpose and function of the common types of lines found on drawings.
 - object lines
 - hidden lines
 - centre lines
 - dimension and extension lines
 - leader lines

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

1.2 Continued

- break lines
- cutting plane lines
- hatch lines
- phantom lines

1.3 Describe the purpose and function of the common views and presentations found on drawings.

- orthographic projection
- front, back, top and side views
- revolved views
- selecting the appropriate "front" or most descriptive view
- isometric drawing
- three-dimensional sketching
- oblique and perspective views
- pictorial drawing
- "true" perspective
- vanishing point
- not to be scaled
- section views
- full and partial sections
- revolved section
- half section

1.4 Describe the commonly available structural steel shapes.

- shapes available
- sheet
 - common sizes and gauge measurement system
- plate
 - commonly available sizes
 - thickness, width and length
- pipe
 - schedules available
 - nominal size and common lengths
 - hollow structural sections (HSS)
 - round
- flat
 - bar
 - square
 - rectangular
 - bar
 - round
 - square
 - hexagonal

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

1.4 Continued

- angle
 - common types and sizes
- channel
 - common types and sizes
 - dimensioning standards
- beams
 - common types and sizes

1.5 Perform assigned drafting and sketching operations. use appropriate drafting tools to complete drawing

- compass
- protractor
- rule
- divider
- complete orthographic drawing of a designated object showing various
 - views
 - front
 - back
 - side
 - top or bottom
 - lines
 - dimensioning
- complete three dimensional drawing or sketch of a designated object
 - isometric
 - oblique
 - pictorial

1.6 Perform assigned shop projects – layout and fitting techniques.

- layout tools
 - imperial and metric rulers
 - T-Squares
 - scales
 - micrometers
 - verniers
 - squares
 - levels
 - compass
 - protractor
- marking lines
 - soap stone line
 - chalk line
 - paint stick
 - centre punch line
 - scribing

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

1.6 Continued

- layout math skills
 - fractions
 - addition
 - subtraction
 - angle measurement
- 5 basic joints
 - butt
 - tee
 - lap
 - corners
 - edge
- structural shapes intersections
 - angles
 - channels
 - beams
 - HSS
 - mitre
 - cope
- layout project(s)
 - material preparation
 - plate
 - structural shapes
 - layout and mark cut lines
 - shapes
 - corners
 - 90 degree mitre
 - cope corner
- manual flame cutting
 - dimensioning material
 - edge preparation
- semi-automatic flame cutting
 - dimensioning material
 - edge preparation
- saws
 - hacksaw
 - cut-off abrasive wheel saw
 - band saws
- hand grinders
- edge and surface preparation

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0882.2 Joint Design and Welding Symbols

Duration: Total 9 hours Theory 9 hours Practical 0 hours

Cross Reference to Training Standard : 6004.01; 6006.01, .02 4.1.3, 9.1

GENERAL LEARNING OUTCOME

Explain the features of joint types, positions and welding symbols as applied to the welder/fabricator programs.

LEARNING OUTCOMES AND CONTENT

- 2.1 Define fundamental joint types and positions
- five basic joints
 - butt
 - tee
 - lap
 - corner
 - edge
 - geometry of joint preparation
 - terminology of joints
 - positions, plate and pipe
 - flat, (1F), (1G)
 - horizontal, (2F), (2G)
 - vertical, (3F), (3G)
 - progression up
 - progression down
 - overhead, (4F), (4G)
 - (5F), (5G), (6G)
- 2.2 Explain the purpose and use of different joints
- application of each basic joint
 - introduction to joint limitations
 - thickness
 - economy
 - process
 - position
 - accessibility
 - distortion
 - complete and partial joint penetration
 - bevelling / chamfering methods

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

- 2.3 Explain the components of welding symbols.
- reference line
 - arrow side and other side significance
 - multiple reference lines
 - arrows
 - broken arrows
 - tail
 - specifications and notes
 - process
 - basic weld symbols
 - fillet
 - groove
 - plug/slot
- 2.4 Explain the design and application of welding symbols.
- groove welds
 - designation of complete and partial penetration groove welds
 - vee groove
 - bevel groove
 - J-groove
 - single and double – combination grooves
 - edge preparations
 - bevel angle
 - included angle
 - chamfer
 - dimensioning
 - root gap
 - root face
 - back or backing welds
 - melt-thru
 - open grooves and use of backing
 - other / auxiliary
 - surface contours and methods of finishing
 - fillet welds
 - continuous
 - intermittent
 - opposite
 - staggered
 - dimensions
 - leg sizes
 - throat
 - face
 - length

2.4 Continued

- other welds
 - plug and slot
 - cladding
 - spot welds
 - auxiliary symbols
 - field weld symbol
 - weld all-around symbol
 - surface contours
 - methods of finishing

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

Number: **S0883**

Reportable Subject: **WELDING THEORY I**

Duration: Total 39 hours Theory 30 hours Practical 0 hours

Co-requisites: Unit 4, 5, 6

Content: S0883.1 Power Sources and Equipment
S0883.2 Shielded Metal Arc Welding (SMAW)
S0883.3 Gas Metal Arc Welding (GMAW)
S0883.4 Flux Cored (FCAW) and Metal Cored (MCAW) Arc Welding

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
80%	0%	10%	10%	

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0883.1 Power Sources and Equipment

Duration: Total 9 hours Theory 9 hours Practical 0 hours

Cross Reference to Training Standard: 6002.02; 6007.01; 6008.01; 6009.01; 6010.01; 6011.01; 6012.01 11.1.1, 11.2.1, 11.3.1, 3.2

GENERAL LEARNING OUTCOME

Describe the functions and controls of welding power sources in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 1.1 Define the functions of welding power sources.
 - constant current
 - constant voltage
 - inverters
 - transformers
 - transformer rectifiers
 - generators
 - engine drives
 - amperage controls
 - principle of inductance
 - tapped control
 - saturable reactor
 - shunt
 - magnetic amplifier
 - SCR
- 1.2 Describe the effects of power source controls on welding processes.
 - amperage
 - voltage
 - voltage trim
 - remote controls
 - output characteristics
 - current type
 - polarity
 - slope control
 - inductance
 - square wave
 - high frequency
 - AC balance
 - transformer rectifier

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

1.2 Continued

- inverter
- welding current output frequency
- inverter controls

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0883.2 Shielded Metal Arc Welding (SMAW)

Duration: Total 9 Hours Theory 9 hours Practical 0 hours

Cross Reference to Training Standard: 6007.01, .02, .03; 6004.01; 6017.01, .04, .05; 6006.03; 6002.03 3.3, 11.1, 11.1.1, 11.1.2, 11.1.3

GENERAL LEARNING OUTCOME

Describe the fundamentals of the Shielded Metal Arc Welding (SMAW) process in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

Upon successful completion, the apprentice is able to:

- 2.1 Define the fundamentals of the Shielded Metal Arc Welding (SMAW) process.
 - development of arc welding
 - method of melting and freezing
 - fusion
 - arc characteristics
 - arc length
 - effect on voltage
 - penetration
 - travel speed
 - optimum
 - effects of too fast or too slow
 - weld contamination protection
- 2.2 Describe the equipment requirements for the Shielded Metal Arc Welding (SMAW) process.
 - power sources
 - transformers
 - rectifiers
 - inverters
 - generators
 - engine driven

2.2 Continued

- power source controls
 - amperage
 - duty cycle
 - voltage
 - current type
 - polarity
- arc force
- electrode holders
 - clamp
 - jaw types
- welding cables
 - cable size and condition
 - connectors
 - relationship to required amperage
 - work lead
 - completion of welding circuit
 - clamps in good repair
 - work lead locations

2.3 Describe the construction and characteristics of Shielded Metal Arc Welding (SMAW) electrodes.

- basic construction features
 - core wire
 - flux covering
 - manufacturing methods of welding electrodes
 - electrode concentricity
 - functions of the flux coating
 - flux coating base material
 - chemical properties and alloying elements
 - shielding
- classification of Shielded Metal Arc Welding (SMAW) electrodes, CSA and AWS.
 - low hydrogen (basic)
 - cellulose
 - rutile
 - iron powder
 - mild steel
 - low alloy
 - stainless steel
 - meaning of each letter and numerical group
 - imperial and metric versions
 - storage and handling
 - electrode conditioning
 - storage temperatures

- 2.4 Describe the Shielded Metal Arc Welding (SMAW) procedure variables and their effect on quality and productivity.
- primary variables (conducted prior to welding)
 - joint design and fit-up
 - consumables
 - current type and polarity
 - amperage
 - pre-heat
 - electrode size
 - secondary variables (conducted during welding)
 - travel speed
 - arc length
 - work angle
 - electrode angle
 - technique
 - whipping
 - weaving
 - stringer
 - multiple passes
 - drag

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0883.3 Gas Metal Arc Welding (GMAW)

Duration: Total 9 Hours Theory 9 hours Practical 0 hours

Cross-Reference to Training Standard: 6017.04, .05; 6002.02 11.2, 11.2.1, 11.2.2, 11.2.3, 3.2, 3.3

GENERAL LEARNING OUTCOME

Describe the fundamentals, construction features and consumables of the Gas Metal Arc Welding (GMAW) process in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 3.1 Define the fundamentals of the Gas Metal Arc Welding (GMAW) process.
- modes of metal transfer
 - short-circuiting transfer
 - spray arc transfer
 - globular
 - pulsed
 - gas shielding
 - purpose
 - types
 - Argon / Helium
 - CO₂
 - mixed gases
 - triple mix gas
- 3.2 Explain safety concerns applicable to the Gas Metal Arc Welding (GMAW) process.
- UV radiation protection
 - appropriate helmet and filter plate
 - spatter and proper safety clothing
 - storage and handling of high pressure cylinders
 - flow meters
 - fumes and gases
 - oxygen depletion

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

- 3.3 Explain the function of the components of the Gas Metal Arc Welding (GMAW) process.
- fundamentals and characteristics of the Constant Voltage power source
 - self- correcting arc gap
 - application of Constant Current power sources
 - wire feeders
 - spool guns
 - push type
 - push-pull type
 - drive rolls
 - liners
 - metallic
 - non-metallic
 - gas diffusers
 - contact tips / contact tubes
 - nozzles
 - water cooled guns
- 3.4 Explain the selection and characteristics of consumables necessary for Gas Metal Arc Welding (GMAW) short-circuit transfer and spray-arc transfer.
- optimal wire type and size (diameter)
 - filler metal classification system
 - low alloy
 - steels
 - stainless steels
 - aluminium
 - types and sizes
 - purpose of copper plating
 - shielding gas
 - types
 - flow rate
- 3.5 Describe the procedure variables for Gas Metal Arc Welding (GMAW) and their affect on quality and productivity.
- primary variables (conducted prior to welding)
 - joint design and fit-up
 - consumables
 - shielding gas
 - current type and polarity
 - amperage
 - wire feed speed

3.5 Continued

- wire diameter
- voltage
- preheat
- secondary variables (conducted during welding)
 - travel speed
 - nozzle to work distance
 - work angle
 - gun angle to work
 - technique
 - stringer
 - multi-passes
 - weaving
 - forehand
 - backhand

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0883.4 Flux Cored Arc Welding (FCAW) and Metal Cored Arc Welding (MCAW).

Duration: Total 3 Hours Theory 3 hours Practical 0 hours

Cross Reference to Training Standard: 6010.01, 02, .03; 6017.04, .05
11.2, 11.2.1, 11.2.2, 11.2.3, 3.2, 3.3

GENERAL LEARNING OUTCOME

Describe the fundamentals of the Flux Cored Arc Welding (FCAW) process and Metal Cored Arc Welding (MCAW) the selection process of the consumables in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 4.1 Define the fundamentals of the Flux Cored Arc Welding (FCAW) process and Metal Cored Arc Welding (MCAW) process.
 - metallic transfer
 - construction of the tubular wire
 - wire types
 - flux types
 - gas shielding
 - purpose
 - types
- 4.2 Explain the function of the components of the Flux Cored Arc Welding (FCAW) process and Metal Cored Arc Welding (MCAW) process.
 - fundamentals and characteristics of the Constant Current power source
 - fundamentals and characteristics of the Constant Voltage power source
 - electrode wire classification
 - types and sizes
 - mechanical feeders
 - drive rolls
 - liners
 - contact tips
 - nozzles
 - gas shielding
 - gas diffusers

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

- 4.3 Describe the selection of welding parameters and consumables necessary for Flux Cored Arc Welding (FCAW) and Metal Cored Arc Welding (MCAW).
- material thickness
 - position of welding
 - voltage
 - wire feed speed
 - wire type and size
 - drive rolls
 - contact tips
 - selection of shielding gas
 - types
 - flow rate
 - gun angle
 - direction of travel

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

Number: **S0884**

Reportable Subject: **MATERIALS AND PROCESS QUALITY I**

Duration: Total 27 hours Theory 27 hours Practical 0 hours

Co-requisites: Unit 2, 4, 5, 6

Content: S0884.1 Distortion
S0884.2 Weld Quality

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
80%	0%	10%	10%	

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0884.1 Distortion

Duration: Total 12 hours Theory 12 hours Practical 0 hours

Cross Reference to Training Standard: 6016.01, .03; 6004.10; 6005.03, .05
5.2, 10.1, 10.2

GENERAL LEARNING OUTCOME

Describe the fundamental causes, effects and correction procedures of distortion in accordance with the effects of heat and stress of metals in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 1.1 Define the fundamental causes of distortion.
 - types of shrinkages
 - transverse
 - longitudinal
 - shape change
 - stress / strain
 - unbalanced shrinkage stresses
- 1.2 Describe the factors affecting distortion.
 - type of metal
 - physical properties effecting distortion
 - thermal conduction
 - thermal expansion
 - carbon vs. austenitic stainless steel
 - aluminums
 - type of joints
 - tee joints
 - single
 - double
 - prepared tee
 - lap joints
 - single sided groove joints
 - double sided groove joints
 - joint volume
 - effect of bevel angle
 - effect of included angle

1.2 Continued

- "J" grooves
- "U" grooves
- material thickness
- welding process
 - Shielded Metal Arc Welding (SMAW)
 - Gas Metal Arc Welding (GMAW)
 - Flux Cored Arc Welding (FCAW)
 - Submerged Arc Welding (SAW)
 - heat input
 - deposition rate
 - manual vs. automatic processes
 - travel speed

1.3 Explain the methods used to prevent distortion.

- welding sequence
- back step
- weld progression
- vertical up
- vertical down
- continuous
- intermittent welding
- pre-setting joint
- preheating
- jigs and fixturing
- weld size
 - effects of over welding
 - multiple passes
 - single pass
 - effects of bead size
 - selection of preventative method
 - distortion allowances

1.4 Describe actions used to correct distortion.

- measuring distortion
- heat wedges
- heat spots
- back welding
- stress relief
- mechanical straightening
- stress / strain
- restraint
- work hardening

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0884.2 Weld Quality

Duration: Total 15 hours Theory 15 hours Practical 0 hours

Cross Reference to Training Standard: 6016.01; 6015.01, .03 11.1.4, 11.1.7, 11.2.4, 11.2.7, 11.3.4, 11.3.7

GENERAL LEARNING OUTCOME

Describe the features of weld quality, welding discontinuity and welding procedures in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 2.1 Define welding discontinuities and their effect on weld quality.
 - types of welding discontinuities
 - weld quality
 - intended function of a weld
 - acceptance criteria of a weld
 - applicable specification
 - acceptable discontinuities
 - unacceptable discontinuities
 - applicable specification
- 2.2 Explain the types and causes of dimensional and / or geometric discontinuities.
 - fillet weld leg
 - throat dimension measurement
 - causes of and significance of insufficient leg length or throat dimension
 - incorrect weld shape
 - convexity
 - concavity
 - excess reinforcement
- 2.3 Identify the types and causes of structural soundness discontinuities.
 - cracks
 - inclusions
 - porosity
 - lack of fusion
 - incomplete fusion
 - undercut
 - overlap

- 2.4 Explain how weld quality is assured through documented welding procedures.
- specification of welding variables within permissible tolerances
 - specification of material type
 - preparation and joint fit-up
 - preheat, interpass, and post-heat temperature requirements
 - electrical characteristics
 - consumables
 - filler metals
 - fluxes
 - shielding gas
 - welding position
 - welding technique
- 2.5 Describe the need for other functions to assure weld quality.
- qualification of welding personnel
 - welding procedure qualification requirements
 - in-process weld monitoring
 - techniques to avoid arc blow
 - post-weld inspection
 - non-destructive testing requirements
- 2.6 Define procedures for correction of defective weld quality.
- defect excavation procedures
 - inspection of cavity prior to weld repair
 - weld repair procedures

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

Number: **S0885**

Reportable Subject: **SHIELDED METAL ARC WELDING (SMAW)
PRACTICAL I**

Duration: Total 69 hours Theory 3 hours Practical 66 hours

Prerequisites: Unit 1, 3

Content: S0885.1 Fillet Welds with Shielded Metal Arc
Welding (SMAW) on Mild Steel
S0885.2 Groove Welds with Shielded Metal Arc
Welding (SMAW) on Mild Steel

Evaluation & Testing: Assignments related to theory and appropriate
application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
10%	90%	0%	0%	

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0885 Fillet Welds with Shielded Metal Arc Welding (SMAW) on Steel Mild

Duration Total 36 Hours Theory 3 hours Practical 33 hours

Cross Reference to Training Standard: 6002.02; 6007.01, .02, .03, .04, .06, .07; 6015.02, .03; 6006.04; 6016.01 3.2, 11.1.1, 11.1.2, 11.1.3, 11.1.4, 11.1.6, 11.1.7, 3.3

GENERAL LEARNING OUTCOME

Perform fillet welding with the Shielded Metal Arc Welding (SMAW) process in accordance with government safety regulations, manufacturer's recommendations and approved industry standards with a focus of meeting or exceeding the testing requirements of C.S.A. W47.3 – 4F position regarding weld quality.

LEARNING OUTCOMES AND CONTENT

- 1.1 Describe the equipment set-up and the process of the Shielded Metal Arc Welding (SMAW) process.
 - power source
 - equipment
 - consumables
 - safety
 - personal protection
 - material
 - technique
 - type of welds
- 1.2 Set-up and maintain equipment for Shielded Metal Arc Welding (SMAW) applications.
 - electrode selection
 - type
 - size
 - power sources
 - transformers
 - rectifiers
 - inverters
 - generators
 - engine driven
 - motor driven
 - power source controls

1.2 Continued

- amperage
- voltage
- current type
- polarity
- electrode holders
- jaw types
- welding cables
- cable size and condition
- relationship to required amperage
- work lead
- completion of welding circuit
- clamps in good repair
- work lead locations
- safety concerns

1.3 Fillet weld mild steel using the Shielded Metal Arc Welding (SMAW) process.

- striking the arc
- running beads
- stops and restarts
- filling crater
- fillet welds
 - tee joint
 - lap joint
- material
 - plate
 - structural shapes
 - structural shapes to plate
- positions
 - 1F
 - 2 F
 - 3 F
 - 4F
- electrodes
 - cellulose
 - rutile
 - basic

- 1.4 Perform post-weld operations.
- methods of cleaning and finishing of completed weld to specifications
 - removing all slag
 - removing all spatter
 - wire brushing
 - filing
 - grinding
 - hand tools
 - power tools
 - measuring welds to meet specifications
 - visual examination of weld for discontinuities
 - porosity
 - cracks
 - slag inclusion
 - undercut
 - overlap

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0885.2 Groove Welds with Shielded Metal Arc Welding (SMAW) on Mild Steel

Duration: Total 33 Hours Theory 0 hours Practical 33 hours

Cross Reference to Training Standard: 6007.03, .05, .06, .07
3.2, 11.1.1, 11.1.2, 11.1.3, 11.1.5, 11.1.6, 11.1.7, 3.3

GENERAL LEARNING OUTCOME

Perform groove welding procedures with the Shielded Metal Arc Welding (SMAW) process in accordance with government safety regulations, manufacturer's recommendations and approved industry standards with a focus of meeting or exceeding the testing requirements of C.S.A. W47.3 – 3GF position regarding weld quality.

LEARNING OUTCOMES AND CONTENT

- 2.1 Prepare base metal for groove welding.
 - type of groove joint
 - welding symbol
 - type of metal
 - backing requirement
 - method of joint preparation
 - surface finish
 - joint opening
 - placement of tacks
 - preheat requirement
- 2.2 Perform groove welding of mild steel using the Shielded Metal Arc Welding (SMAW) process.
 - single bevel
 - backing bar
 - single vee-groove
 - backing bar
 - flat position (1G)
 - structural shapes
 - GF combination test plates
 - 1GF
 - 2GF
 - 3GF
 - electrodes
 - cellulose
 - rutile
 - basic

- 2.3 Perform post-weld operations.
- methods of cleaning completed weld to specifications
 - removing all slag
 - removing all spatter
 - wire brushing
 - sand/shot blasting
 - filing
 - grinding
 - hand tools
 - power tools
 - measuring welds to meet specifications
 - visual examination of weld for defects
 - porosity
 - cracks
 - slag inclusion
 - undercut
 - overlap
 - incomplete penetration
 - inspection of welds
 - non-destructive test methods
 - destructive test methods

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

Number: **S0886**

Reportable Subject: **GAS SHIELDED SEMI-AUTOMATIC WELDING PRACTICAL I**

Duration: Total 54 hours Theory 2 hours Practical 52 hours

Content:

- S0886.1 Fillet Welds with Gas Metal Arc Welding (GMAW)
- S0886.2 Groove Welds with Gas Metal Arc Welding (GMAW)
- S0886.3 Fillet Welds with Flux Cored Arc Welding (FCAW)
- S0886.4 Groove Welds with Flux Cored Arc Welding (FCAW)

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
10%	90%	0%	0%	

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0886.1 Fillet Welds with Gas Metal Arc Welding (GMAW)

Duration: Total 21 hours Theory 1 hours Practical 20 hours

Cross Reference to Training Standard: 6017.01, .02; 6006.04, .06; 6015.02; 6016.01 11.2.1 -11.2.4, 11.2.6 – 11.2.7, 32, 3.3 11.2.7

GENERAL LEARNING OUTCOME

Perform fillet welding with the Gas Metal Arc Welding (GMAW) process in accordance with government safety regulations, manufacturer's recommendations and approved industry standards with a focus of meeting or exceeding the testing requirements of C.S.A. W47.3 – 2F position regarding weld quality.

LEARNING OUTCOMES AND CONTENT

- 1.1 Describe equipment set-up and the process of the Gas Metal Arc Welding (GMAW).
 - power source
 - wire feeder
 - shielding gas
 - consumables
 - safety
 - personal protection
 - material
 - technique
 - type of welds
- 1.2 Set-up and maintain equipment for a variety of Gas Metal Arc Welding (GMAW) applications.
 - consumables for the application
 - wire type
 - size
 - gas type
 - welding parameters
 - voltage
 - wire feed speed
 - gas flow rate
 - maintenance of equipment
 - work lead connection
 - mechanical feeders

1.2 Continued

- drive rolls
- spool axle tension
- contact tip
- gun nozzle
- gun liner
- wear
- restriction
- loops
- circulator
- changing shielding gas cylinders
- gas leaks

1.3 Perform fillet welding using the Gas Metal Arc Welding (GMAW) process on mild steel.

- pre-cleaning and preparation
- modes of metal transfer
 - short circuit
 - spray
 - globular
- fillet welds
 - lap joint
 - tee joint
 - corner joint
 - flat position (1F)
 - horizontal position (2F)
 - plate and sheet
 - structural shapes
 - structural shapes to plate
- consumables
 - wire
 - shielding gas

1.4 Perform post weld operations.

- clean and finish welds to specifications
- visually inspect and evaluate finished welds

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0886.2 Groove Welds with Gas Metal Arc Welding (GMAW)

Duration: Total 15 hours Theory 0 hours Practical 15 hours

Cross Reference to Training Standard: 6017.01, .02; 6015.02; 6002.02; 6010.01, .02, .03, .04, .05, .06, .07; 6016.01 11.2.1 – 11.2.3, 11.2.5 – 11.2.7, 3.2

GENERAL LEARNING OUTCOME

Perform groove welding with the Gas Metal Arc Welding (GMAW) process in accordance with government safety regulations, manufacturer's recommendations and approved industry standards with a focus of meeting or exceeding the testing requirements of C.S.A. W47.3 – 2G position regarding weld quality.

LEARNING OUTCOMES AND CONTENT

- 2.1 Prepare base metal for groove welding.
 - type of groove joint
 - welding symbol
 - type of metal
 - backing requirements
 - method of joint preparation
 - surface finish
 - joint opening
 - placement of tacks
 - preheat requirement

- 2.2 Perform groove welding on mild steel using the Gas Metal Arc Welding (GMAW) process.
 - pre-cleaning and preparation
 - modes of metal transfer
 - short circuit
 - spray
 - globular
 - single bevel
 - backing
 - double bevel
 - single vee-groove
 - flat position (1G)
 - horizontal position (2G)
 - plate
 - structural shapes

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

2.2 Continued

- consumables
 - wire
 - shielding gas

2.3 Perform post weld operations.

- clean and finish welds to specifications
- visually inspect and evaluate finished welds

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0886.3 Fillet Welds with Flux Cored Arc Welding (FCAW)

Duration: Total 9 hours Theory 1 hours Practical 8 hours

Cross Reference to Training Standard: 6010.01, .02, .03, .04, .06, .07

GENERAL LEARNING OUTCOME

Perform fillet welding with the Flux Cored Arc Welding (FCAW) process in accordance with government safety regulations, manufacturer's recommendations and approved industry standards with a focus of meeting or exceeding the testing requirements of C.S.A. W47.3 – 2F position regarding weld quality.

LEARNING OUTCOMES AND CONTENT

- 3.1 Describe equipment and the process of the Flux Cored Arc Welding (FCAW).
 - power source
 - wire feeder
 - shielding gas
 - consumables
 - safety
 - personal protection
 - material
 - technique
 - type of welds
- 3.2 Set up equipment for a variety of Flux Cored Arc Welding (FCAW) applications.
 - consumables for the application
 - wire type
 - gas shielded
 - self-shielded
 - size
 - gas type
 - welding parameters
 - voltage
 - wire feed speed
 - gas flow rate

3.2 Continued

- maintenance of equipment
 - work lead connection
 - wire feeders
 - drive rolls
 - spool axle tension
 - contact tip
 - gun nozzle
 - gun liner
 - wear
 - restriction
 - loops
 - water cooled guns
 - circulator
 - changing shielding gas cylinders
 - gas leaks

3.3 Perform fillet welding of mild steel using the Flux Cored Arc Welding (FCAW) process.

- fillet welds
 - lap joint
 - tee joint
 - corner joint
 - flat position (1F)
 - horizontal position (2F)
 - plate
 - structural shapes
 - structural shapes to plate
- consumables
 - wire
 - shielding gas

3.4 Perform post weld operations.

- clean and finish welds to specifications
- visually inspect and evaluate finished welds

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0866.4 Groove Welds with Flux Cored Arc Welding (FCAW)

Duration: Total 9 hours Theory 0 hours Practical 9 hours

Cross Reference to Training Standard: 6010.01, .02, .03, .05, .06, .07

GENERAL LEARNING OUTCOME

Perform groove welding with the Flux Cored Arc Welding (FCAW) process in accordance with government safety regulations, manufacturer's recommendations and approved industry standards with a focus of meeting or exceeding the testing requirements of C.S.A. W47.3 – 2G position regarding weld quality.

LEARNING OUTCOMES AND CONTENT

- 4.1 Prepare base metal for groove welding.
 - type of groove joint
 - welding symbol
 - type of metal
 - backing requirements
 - method of joint preparation
 - surface finish
 - joint opening
 - placement of tacks
 - preheat requirement

- 4.2 Perform groove welding on mild steel using the Flux Cored Arc Welding (FCAW) process.
 - single bevel
 - backing bar
 - single vee-groove
 - backing bar
 - flat position (1G)
 - plate
 - consumables
 - wire
 - shielding gas

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

4.3 Perform post weld operations.

- clean and finish welds to specifications
- visually inspect and evaluate finished welds

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

Number: **S0887**

Reportable Subject: **THERMAL CUTTING**

Duration: Total 27 hours Theory 9 hours Practical 18 hours

Content: S0887.1 Oxy-Fuel-Gas Cutting
S0887.2 Plasma Arc Cutting
S0877.3 Air Carbon Arc Gouging

Evaluation & Testing: Assignments related to theory and appropriate application skills
Minimum of one mid-term test during the term
Final exam at end of term
Periodic quizzes

Mark Distribution:

Theory Testing	Practical Application Testing	Projects	Notebook and Organizational Skills	Final Assessment
30%	50%	10%	10%	

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0887.1 Oxy-Fuel-Gas Cutting

Duration: Total 9 hours Theory 3 hours Practical 6 hours

Cross Reference to Training Standard: 6017.01, .04, .05; 6002.01; 6003.02; 6004.02; 6006.04 9.2.1, 3.1

GENERAL LEARNING OUTCOME

Perform safe set-up, operation and correction of common cutting faults for the Oxy-Fuel Cutting equipment applications in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 1.1 Define safety related concepts.
- personal protection
 - clothing
 - safety glasses
 - cutting goggles
 - hearing protection
 - noise protection
 - fumes protection
 - protection against falling material
 - cylinders
 - basic construction and features
 - fusible plugs
 - rupture disk
 - flashback arrestors
 - reverse flow check valves
 - fire hazards
 - flammable distances of sparks / dross
 - fire prevention
 - fire blankets
 - fire extinguishers
 - oxygen hazards
 - maintenance

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

1.2 Describe the characteristics, applications and control of gases.

- manifold systems
- arrestors
- fuel gases
 - acetylene
 - maximum safe pressure
 - safe withdrawal rates
 - cylinder handling
 - type of piping
 - propane
 - polypropylene
 - MAPP
 - natural gas
 - flammable ranges
 - oxygen
 - fire hazard
 - explosion hazard
- liquid bulk storage
- cylinder handling
- preparing the work site
 - fire hazards
- cutting closed containers
 - cleaning
 - water filling
 - purging
- cutting in confined spaces

1.3 Explain the operation and handling of oxy-fuel equipment.

- secure cylinders
- gauges
- hoses
 - sizes
 - colour
 - length
- torches
 - manual and machine
 - heating equipment
 - fittings
 - tips
 - installing
 - types
 - size selection
 - cleaning
 - gas pressures
 - maintenance

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

- 1.4 Set up, light and shut down equipment.
 - safe set up
 - correct lighting procedure
 - correct shut down procedure

- 1.5 Perform manual oxy-fuel-gas cutting.
 - square cuts
 - bevel cuts
 - piercing
 - straight cutting
 - shape cutting
 - gas pressures
 - speed of travel
 - tip to metal distance

- 1.6 Correct common cutting faults.
 - cut edge quality
 - kerf lines
 - dross (slag) adherence

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0887.2 Plasma Arc Cutting

Duration: Total 9 hours Theory 3 hours Practical 6 hours

Cross Reference to Training Standard: 6017.01, .04, .05; 6004.05
9.2.3, 3.2

GENERAL LEARNING OUTCOME

Perform safe set-up, operation and correction of common cutting faults for the Plasma Arc Cutting equipment in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 2.1 Define safety related concepts.
 - personal protection
 - electrical safety
 - grounding
 - bonding
 - radiation
 - heat
 - noise
 - fumes
 - high open circuit voltage
 - high pressure cylinders
 - compressed air pressure

- 2.2 Explain the features of plasma arc cutting equipment.
 - power supplies
 - torches
 - secure cylinders
 - gauges
 - hoses
 - fittings
 - tips
 - pressures
 - speed of travel
 - types of cuts
 - material types
 - material thickness
 - piercing
 - quality control

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

- 2.3 Cut manually using plasma arc equipment.
- set-up parameters
 - square cuts
 - bevel cuts
 - piercing
 - straight cutting
 - shape cutting
 - shut down
- 2.4 Correct common cutting faults.
- cut edge quality
 - kerf lines
 - cutting direction based on square side of cut
 - dross adherence (slag)

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

S0887.3 Air Carbon Arc Gouging

Duration: Total 9 hours Theory 3 hours Practical 6 hours

Cross Reference to Training Standard: 6017.01, .04, .05; 6004.03; 6016.01; 6015.01 9.2.2, 3.2

GENERAL LEARNING OUTCOME

Perform safe set-up, operation and correction of common cutting faults for the Air Carbon Arc Gouging equipment in accordance with government safety regulations, manufacturer's recommendations and approved industry standards.

LEARNING OUTCOMES AND CONTENT

- 3.1 Define safety related concepts.
 - personal protection
 - electrical
 - radiation
 - fire hazards
 - flammable distances of sparks / dross
 - fire prevention
 - fire blankets
 - fire extinguishers
 - compressed air
 - noise
 - fumes
 - preparing the work site
- 3.2 Explain the operation and handling of equipment.
 - power supplies
 - amperage
 - voltage
 - torches
 - electrode selection
 - diameter
 - shapes
 - hoses
 - fittings
 - compressed air pressures
 - speed of travel
 - types of cuts

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

3.2 Continued

- depth of cut
- material types
- quality control

3.3 Gouge manually using carbon arc equipment.

- defect excavation
 - weld removal
 - back gouging to sound metal
 - weld joint preparation

3.4 Correct common cutting faults.

- cut edge quality
- post cleaning

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

ONTARIO WELDER/ METAL FABRICATOR APPRENTICESHIP PROGRAM

Suggested minimum equipment list for
Training Delivery Agents

POWER SOURCES AND EQUIPMENT	QUANTITY
SMAW (CC) (AC/DC) power source and equipment	1 per apprentice
GMAW / FCAW / MCAW (CV) power source and equipment (Capable of Spray-transfer)	1 per apprentice
GMAW-PULSED power source and equipment	1 per 5 apprentices
Pulsed power source and equipment, Water-cooled torch, Foot controller	
Plasma Arc Cutting power source and equipment	1 per 5 apprentices
Air-Carbon-Arc-Gouging power source and equipment	1 per 5 apprentices
Oxy-Fuel-Gas Manual Cutting equipment	1 per apprentice
Oxy-Fuel-Gas Semi-Automatic Cutting equipment	1 per 5 apprentices
Oxy-Fuel-Gas-Heating Torch and equipment	1 per 5 apprentices
Approved Electrode Storage Oven	1 per shop
Compressed Air Supply (80-100 PSI)	1 per shop

OPTIONAL POWER SOURCES AND EQUIPMENT

Plasma Arc Welding power source and equipment	1 per shop
Sub-Arc Welding power source and equipment	1 per shop
Stud welding power source and equipment	1 per shop

FABRICATION MACHINES (1 each per shop)

Plate Shear
Brake Press
Roll Bending Machine
Band Saw
Nibbler
Ironworker
Pedestal grinders
Cut-off abrasive wheel saw
Weld-bevel preparation equipment for plate and pipe
Weld-coupon bending apparatus
Approved smoke extraction/air make-up unit

Welding and Fabricating shops must be well lit, appropriately heated and ventilated

BASIC HAND TOOLS AND EQUIPMENT (1 per apprentice)

Adjustable wrenches (various sizes)
Allen wrenches (metric and imperial)
Bench vice
“C” clamps (various sizes)
Chalk-line
Cold chisels (various sizes)
Electric extension cords
Files (flat, half-round, rat-tail, bastard)
Friction lighter
Grinding and sanding disks (for carbon steel, aluminum and stainless steel)
Hacksaw
Hammers (chipping, ball peen, claw, sledge, various sizes)
Hand shears
Layout table
Magnets
Metal markers
Pipe clamps
Pipe cutter
Pipe wrenches
Pliers (needle nose, slip joint)
Positioners
Pry bars
Punches
Screwdrivers (slot, Phillips, Robertson, various sizes)
Scribers
Snips (heavy duty sheet metal cutting)
Soapstone markers
Socket sets (metric and imperial)
Temperature indicating crayons
Tip cleaners
Toolboxes
Tungsten sharpening grinders
Vice grips (various sizes and types)
Wire brushes (for carbon steel, aluminum and stainless steel)
Wire cutters
Work bench
Wrench sets (open and closed ends, both metric and imperial)

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

MEASURING TOOLS (1 per apprentice)

Drafting equip	Combination square
Fillet gauges	Spirit level
Vernier caliper	Square
Micrometer	Straight edge
Scriber	Tape measure

POWER TOOLS AND EQUIPMENT (1 per 5 apprentices)

Electric drills [9mm (3/8") to 12.5mm (1/2") chuck size]	Wire wheel (angle grinder with wire brush)
Grinders, electric and/or pneumatic (wire brush, angle grinders)	Sanders

HOISTING AND LIFTING EQUIPMENT (1 per shop)

Rope	Come-along (cable or chain)
Slings	Forklift
Chains	Overhead hoist or crane

SAFETY EQUIPMENT (1 per apprentice)

Earplugs and muffs	Leather gloves
Face shields	Leather jackets
Fire blankets	Masks (particle, vapor)
Fire extinguishers	Respirators
Goggles	Safety glasses
Leather aprons	

RESOURCE MATERIALS

Codebooks
Engineering specifications
Manufacturers' specifications, manuals and charts
Safety manuals

WELDER & METAL FABRICATOR LEVEL I – COMMON CORE

REFERENCE MATERIAL:

Modern Welding Technology, 4th Ed. Howard B. Cary, ISBN 0-13-241803-7

GCIL Learning Modules 1 to 23, Gooderham Centre for Industrial Learning

Blueprint Reading for Welders, A. E. Bennett

Practical Problems in Mathematics for Welders, Frank R. Schell & Bill J. Matlock

Welding Handbook, latest Edition, American Welding Society

ILM Alberta Learning Modules



